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# Durham Region Water and Wastewater GHG Emissions Management Strategy

March 2025

## Net Zero Water

**CASE STUDY**

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# Durham Region Water and Wastewater GHG Emissions Management Strategy

## Key Insights

- Senior leadership support is necessary to drive large-scale mitigation action. Support for the alignment of a long-term GHG strategy specific to water and wastewater assets with the Corporate Climate Action Plan supports organizational actions toward net zero.
- GHG mitigation opportunities offer co-benefits with respect to process performance, stability, resiliency, or capacity.
- Use findings to inform the development of master plans (ie. Biosolids) and other future planning and design projects.
- Collaborate with academic researchers, consultants, and technology vendors to adapt to future changes and technology developments.



**Jacobs**





## Background

In [January 2020](#), the Regional Municipality of Durham (Durham Region) declared a climate emergency. In [March 2021](#), the Durham Regional Council approved the adoption of a [Corporate Climate Action Plan \(CCAP\)](#), which set the following greenhouse gas (GHG) reduction goals for the Region's corporate operations (Durham Region, 2021):

- 20% below 2019 levels by 2025
- 40% below 2019 levels by 2030
- 100% below 2019 levels by 2045

The CCAP recognized that the reported emissions associated with water and wastewater operations are subject to a higher degree of uncertainty than those from the consumption of energy and identified that further efforts were necessary to develop a more comprehensive roadmap for GHG emissions management for water and wastewater (W&WW) systems.

In March 2022, the Durham Region initiated the Water and Wastewater Greenhouse Gas Emissions Management Strategy project with Jacobs to develop a long-term GHG Management Strategy for all Regional W&WW facilities over the next 20 years.

The Durham Region Water and Wastewater Greenhouse Gas Emissions Management Strategy is the first project of its kind in Ontario to establish GHG reduction targets specific to the water and wastewater sector, considering the 'possibility' and 'reality' of GHG mitigation in Ontario. The project received the 2023 Ontario Water Works Association/Water Environment Association of [Ontario Climate Action Award](#) (GHG Reduction & Mitigation Stream).

## Challenges

Leadership on climate change and sustainability is a key strategic priority for Durham Region, as reflected in the Region's strategic plan and Regional Official Plan. Durham Region has developed [several programs](#) to reduce the environmental impact and costs associated with municipal operations and is actively pursuing initiatives to reduce GHG emissions from regionally-owned buildings, fleet, and facilities.

The Region owns and operates 14 drinking water systems across its eight area municipalities, including 6 surface water supply plants (WSPs) and 8 groundwater well systems with a total treatment capacity of 500 million litres per day (ML/d).

The drinking water is supplied to residents and businesses in Durham Region through a distribution system consisting of 10 water pumping stations, 13 water storage facilities, 8 combined water pumping/storage facilities, and 2,615 kilometres (km) of water mains.

The Region owns and operates 11 Water Pollution Control Plants (WPCP) with a total treatment capacity of 865 ML/d, 51 sanitary pumping stations, and more than 2,000 km of sewers to service residents and businesses of both Durham and York Regions.

The Duffin Creek WPCP, located in Pickering on the shores of Lake Ontario, is one of the largest wastewater treatment facilities in Canada. It has a total treatment capacity of 630 ML/d, serving communities from Durham Region and York Region. The Duffin Creek WPCP provides centralized management of the Region's biosolids through dewatering and incineration, including solids generated onsite, and anaerobically or aerobically digested biosolids from Durham Region's other WPCPs.

In this study, all the GHG emissions associated with Duffin Creek WPCP only represent the net Durham share (estimated at 20 percent of the total emissions at Duffin Creek WPCP based on the historical split of flows and loads between Durham and York Regions).

## GHG Inventory

Recognizing that it is not practical to include all applicable Scope 1, 2 and 3 emissions, the development of Durham Region's GHG inventory considered the following:

- industry best practices
- applicable local and federal GHG reporting requirements
- availability and accuracy of quantification methodologies for each source
- the level of complexity and difficulty in quantifying emissions
- whether mitigation measures are available (such that the contribution to GHG reduction goals can be reasonably quantified)

Table 1 summarizes the Scope 1, 2 and 3 emissions recommended to be included in the Region's inventory that are generally consistent with the current best practice established in the 2019 Intergovernmental Panel on Climate Change (IPCC) [refinement to the 2006 IPCC guidelines](#).

The recommended inventory captures significant emission sources from the Region's W&WW facilities. However, setting GHG reduction objectives for all emissions sources is currently not practical, given the difficulty and uncertainty associated with the quantification methods.

Therefore, only Scope 1 and Scope 2 emissions from the inventory are considered for GHG reduction objectives in this project (consistent with the CCAP).



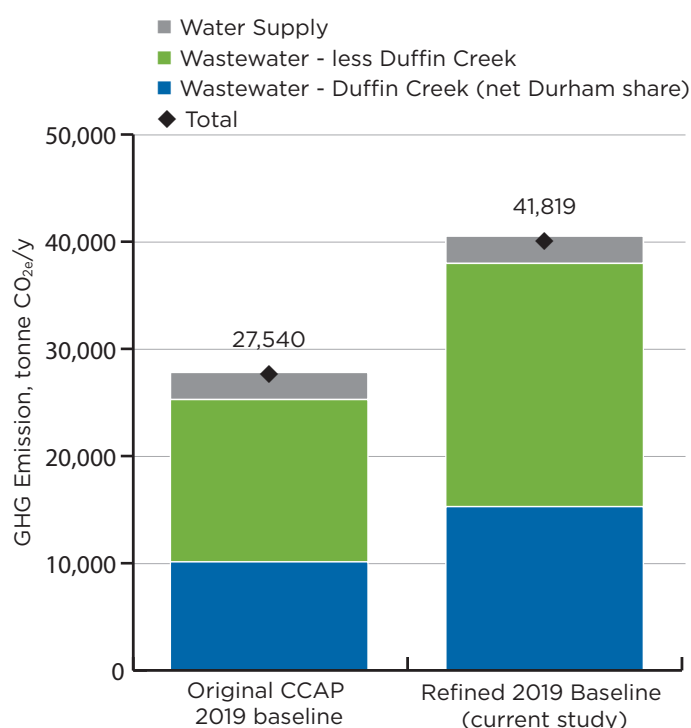
**Table 1:** GHG emission sources included in inventory and for objective setting

Scope	Emission source	Applicability	Included in objective setting
Scope 1	N <sub>2</sub> O from wastewater treatment	WW	Yes
Scope 1	N <sub>2</sub> O from wastewater effluent	WW	Yes
Scope 1	CH <sub>4</sub> from wastewater treatment	WW	Yes
Scope 1	CH <sub>4</sub> from wastewater effluent	WW	Yes
Scope 1	CH <sub>4</sub> from sludge treatment	WW	Yes
Scope 1	Fossil fuel combustion	W&WW	Yes
Scope 1	Biogas combustion (boilers)	WW	Yes
Scope 1	Biogas flaring	WW	Yes
Scope 1	Biomass incineration	WW	Yes
Scope 2	Electricity consumption	W&WW	Yes
Scope 3	Chemicals	W&WW	No
Scope 3	Offsite biosolids and residuals (ash) management	WW	No

It is recommended that Scope 3 emissions be quantified and tracked to assist decision-making, and target setting can be considered in the future as improved methodologies and data sources become available.

The inventory used in the CCAP includes emissions associated with energy consumption and limited process emissions. A more comprehensive GHG inventory was established for this project, which resulted in an approximately 50 percent increase in the 2019 baseline emission (Scope 1&2 only) compared with the CCAP baseline.

The CCAP inventory was expanded to include additional Scope 1 process emissions (CH<sub>4</sub> and N<sub>2</sub>O) consistent with the 2019 IPCC Refinement, along with some improvements in the quantification methodologies.



**Figure 1:** Re-baseline of 2019 Scope 1 & 2 GHG emissions (CCAP Base Year)

Although only Scope 1&2 emissions are included in the target setting, Scope 3 emissions from the inventory were quantified for the 2019 base year, as summarized in Figure 1.

As outlined in Figure 2, the water systems only accounted for 8 percent of the total emissions, with approximately equal contributions from Scope 1, 2 and 3. The wastewater systems

accounted for 92 percent of the total emissions, where Scope 1 process emissions contributed to more than three-quarters of the wastewater emissions.

The very low Scope 2 emissions (electricity) are attributed to the low-intensity electricity grid in Ontario (largely consisting of nuclear, hydro, and renewables).

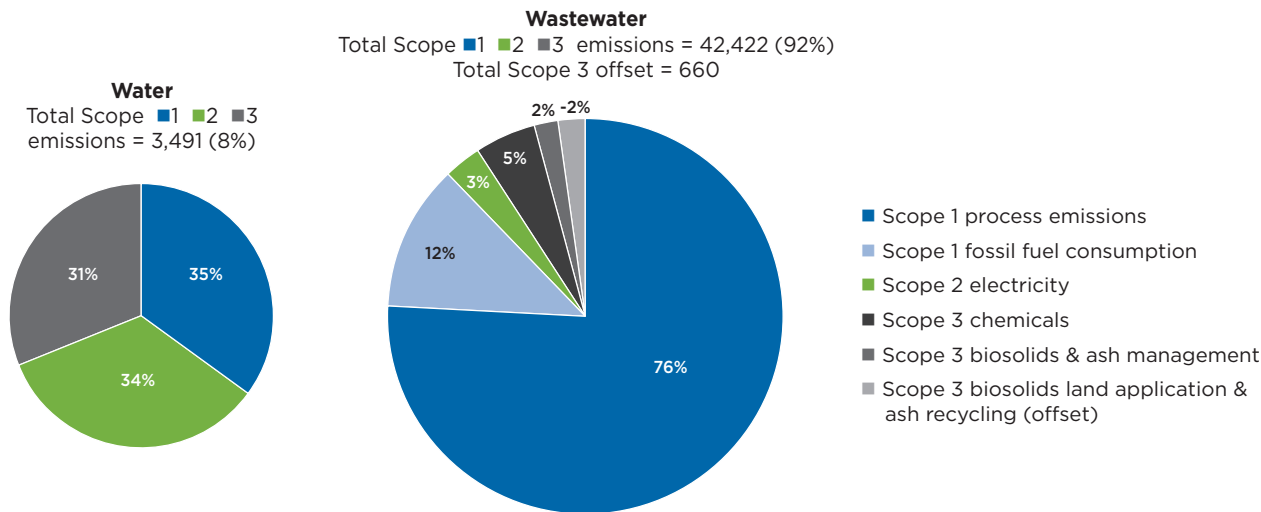


Figure 2: 2019 Baseline GHG Emissions by scope: water and wastewater

# GHG Reduction Objectives

Figure 3 presents the projected GHG reduction progress for the Region’s water and wastewater operations (Scope 1&2 only) relative to the business-as-usual projection and the CCAP targets.

The achievable reduction potential was established based on detailed analyses of GHG mitigation opportunities with information available to reasonably quantify the GHG reduction potential and estimate the operational and financial impacts to the Region.

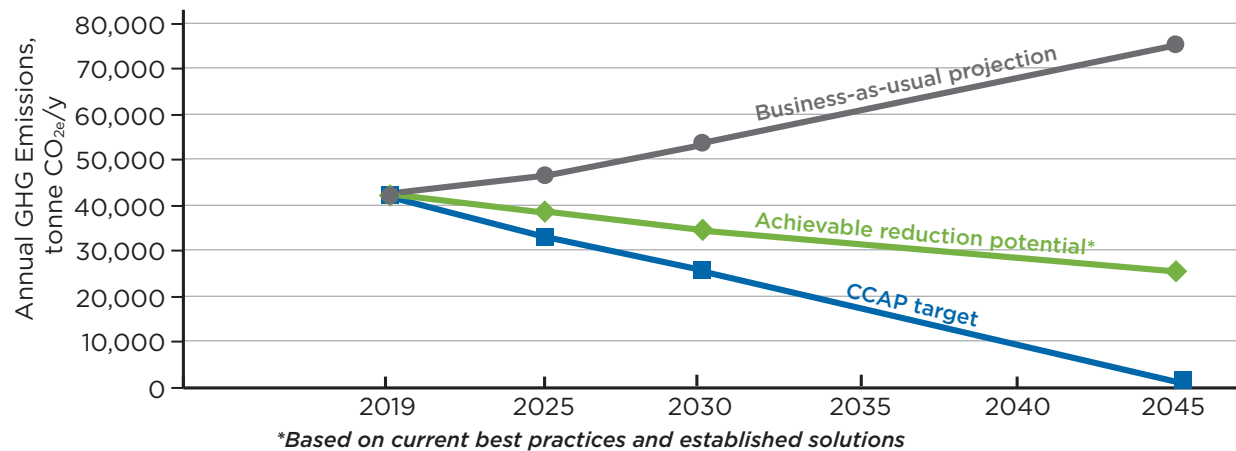


Figure 3: Projected reduction progress for Durham Region’s water and wastewater GHG emissions (Scope 1 & 2)



## Road Map to Net-Zero Emissions

The project established a transparent framework that clearly defines the scope of GHG emissions included in the inventory, the methodologies used to quantify these emissions, the associated limitations and opportunities for improvement, and changes from the previous methodologies – allowing the Region to re-baseline the GHG emissions to include additional emission sources and refine the reduction targets as the quantification methodologies continue to evolve and improve.

A road map was developed for the Region's water and wastewater systems to 2045 (consistent with the CCAP), including an action plan with key GHG mitigation opportunities in the short- (2025), medium (2030), and long-term (2045). Meaningful GHG reduction commitments were established based on comprehensive assessments of net-zero solutions that considered the technical feasibility and operational and financial impacts to the Region.

The top three GHG reduction opportunities account for more than 90% of the long-term GHG reduction potential:

### 1. Reducing process N<sub>2</sub>O emissions from wastewater treatment

The Region has deployed two liquid-phase N<sub>2</sub>O sensors at the Duffin Creek WPCP since the summer of 2023 to position the Region to better understand the quantities and factors affecting N<sub>2</sub>O emissions at the plant.

### 2. Sewer thermal recovery from the collection system

It is critical that the Region develops a sewer thermal recovery policy and establish a standard approach for implementing sewer thermal recovery projects, including clear definition of responsibilities, cost sharing, and allocation of environmental attributes among different stakeholders.

### 3. Biogas upgrade to RNG for grid injection

The Region's WPCPs generate enough biogas that can be purified to RNG to offset natural gas use at the WPCPs, with excess RNG available for grid injection to be used by other Region facilities to offset the natural gas use (and associated displacement of GHG emissions) by corporate operations.

# Lessons Learned

Recommended GHG mitigation opportunities also offer co-benefits with respect to process performance, stability, resiliency, or capacity. Recognizing the synergies, the recommendations from this study will inform the development of the upcoming biosolids master plan study, and other future planning and design projects as appropriate.

The Region acknowledges significant gaps in achieving net-zero emissions in a cost-effective manner based on technologies available today, and the need to be proactive in expediting some projects and adopting other innovative net-zero solutions as they become more established.

The Region is committed to continuing efforts in GHG mitigation through collaboration

with academic researchers, consultants, and technology vendors, with a goal to adapt to future changes and technology developments to progress towards its net-zero commitment in the long term.

Moving forward, this study will be updated every five years to reflect the latest developments in quantification methods, and to refine the GHG reduction targets based on the Region's mitigation progress and available decarbonization technologies at that time.

**To learn more about how GHG Inventory aligns with CWN's "Charting the Course to Net Zero Water in Canada" project, contact [info@cwn-rce.ca](mailto:info@cwn-rce.ca).**

## Be Ambitious: Durham Region's Water and Wastewater Net-Zero GHG Roadmap

[Download weftec2024 proceedings](#)

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